REMARKS

Claims 1-9 are pending in this application.

By this Amendment, claim 10 is canceled without prejudice to or disclaimer of the subject matter therein. Claims 1, 5 and 7 are amended for clarity, as the Examiner requested. Also amended is the specification for clarity, as the Examiner requested. No new matter is added. Reconsideration of the application is respectfully requested.

The Office Action objects to the specification. The specification is amended, as outlined above, based on the Examiner's suggestions. Accordingly, withdrawal of the objection to the specification is respectfully requested.

The Office Action rejects claims 1, 5, 7 and 10 under 35 U.S.C. §112, second paragraph. Claim 10 is canceled, and claims 1, 5 and 7 are amended as the Examiner requested. Accordingly, withdrawal of the rejection of claims 1, 5, 7 and 10 under 35 U.S.C. §112, second paragraph is respectfully requested.

The Office Action rejects claims 1-10 under 35 U.S.C. §103(a) over WO 02/102738 (Reference 1) in view of U.S. Patent No. 6,093,339 (Reference 2). This rejection is moot with regard to canceled claim 10, and is respectfully traversed with regard to remaining claims 1-9.

The piezoelectric ceramic recited in claim 1 includes a composition including a first perovskite-type oxide, a second perovskite-type oxide containing zirconium, and a tungsten bronze-type oxide, which respectively have a predetermined composition. In such a piezoelectric ceramic, an amount of displacement is increased and sintering is easily made.

On the other hand, Reference 1 (WO 02/102738A1) discloses a piezoelectric ceramic including a composition including a perovskite-type oxide containing sodium, potassium and niobium, a perovskite-type oxide containing titanium, and a tungsten bronze-type oxide. Unlike claim 1, Reference 1 does not disclose or suggest including a perovskite-type oxide

containing zirconium. Thus, the piezoelectric ceramic of claim 1 includes different kinds of oxides from Reference 1. This results in different range of numeric value specifying the composition of the piezoelectric ceramic. As a result, the piezoelectric ceramic of claim 1 has different constituent features from Reference 1.

Moreover, the piezoelectric ceramic of claim 1 can obtain larger amount of displacement than that of Reference 1. To clearly demonstrate this, the comparison between the piezoelectric ceramic of claim 1 and the piezoelectric ceramic of Reference 1 was made. The results are shown below.

First, the results of Examples 2-1 to 2-7 shown in Table 3 in the present application were compared to the results of Examples 11-1 to 11-13 shown in Comparison Table 11 in Reference 1. The comparison results are shown in the attached Comparison Table 1. The piezoelectric devices of Examples 2-1 to 2-7 in the present application use the piezoelectric substrate containing the composition shown in Chemical formula 7 in the present application, as a main component. The piezoelectric devices of Examples 11-1 to 11-13 in Reference 1 use the piezoelectric substrate containing the composition shown in Chemical formula 17 in Reference 1, as a main component. The values x, y and m in Chemical formulas 7 and 17 are also shown in the attached Comparison Table 1.

The piezoelectric devices of Examples 2-1 to 2-7 in the present application and Examples 11-1 to 11-13 in Reference 1 are fabricated by the same process as described in each application. Therefore, the relative dielectric constant, the electromechanical coupling factor and the amount of displacement were measured by the same measuring method using the same measuring conditions.

In the attached Comparison Table 1, Examples 11-1 to 11-13 in Reference 1 each correspond to Examples 2-1 to 2-7 as comparative examples. The corresponding relation is as follows.

Present application	Reference 1 (Comparative example)
Example 2-1	Examples 11-1 and 11-2
Example 2-2	Examples 11-3 and 11-4
Example 2-3	Example 11-5
Example 2-4	Examples 11-6 and 11-7
Example 2-5	Examples 11-8 and 11-9
Example 2-6	Examples 11-10 and 11-11
Example 2-7	Examples 11-12 and 11-13

Example 11-1 in Reference 1 is the same piezoelectric device in Comparative example 2-1 shown in Table 2 in the present application. Similarly, Examples 11-3, 11-6, 11-8, 11-10 and 11-12 each are the same piezoelectric device in Comparative examples 2-2 to 2-6 in the present application.

As shown in the attached Comparison Table 1, in Examples 2-1 to 2-7 in the present application, the amount of displacement is larger than the comparative examples (Examples 11-1 to 11-13 in Reference 1). This is because the piezoelectric ceramic of the present application has a second perovskite-type oxide containing an alkali earth metal element, zirconium and oxygen, whereas the second perovskite-type oxide of the piezoelectric ceramic in Reference 1 includes titanium, instead of zirconium.

Next, to clearly demonstrate that the amount of displacement of the piezoelectric ceramic in the present application is larger than that of Reference 1 in the case of applying voltage in actual use, the below-mentioned Experimental test was conducted.

As Experimental examples 1 to 7, the piezoelectric substrates having the same composition as the piezoelectric substrates of Example 2-1 to 2-7 of the present application were fabricated. To measure the amount of displacement with higher precision, the fired

body obtained by firing was processed into a disk shape with a thickness of 2 mm to form the piezoelectric substrate.

As Comparative examples 1 to 13 relative to Experimental examples 1 to 7, the piezoelectric devices using the piezoelectric substrate having the same composition as Examples 11-1 to 11-13 of Reference 1 were fabricated with the process similar to Experimental examples 1 to 7. The correspondence relation between the Experimental examples and the comparative examples are as follows.

Experimental example 1	Comparative examples 1 and 2
Experimental example 2	Comparative examples 3 and 4
Experimental example 3	Comparative example 5
Experimental example 4	Comparative examples 6 and 7
Experimental example 5	Comparative examples 8 and 9
Experimental example 6	Comparative examples 10 and 11
Experimental example 7	Comparative examples 12 and 13

When measuring the amount of displacement, the voltage of 2 kV/mm almost equal to the application voltage in practical use was applied.

When the amount of displacement for Experimental examples 1 to 7 and Comparative examples 1 to 13 were measured, the results shown in the attached Comparison Table 2 were obtained.

As Comparison Table 2 shows, in the case where the thickness of the piezoelectric substrate or the voltage applied was changed, the same results as shown in the attached Comparison Table 1 were obtained. That is, the amounts of displacement in Experimental examples 1 to 7 were larger than that of Comparative examples 1 to 13. The results show that the piezoelectric ceramic of the present application has a large amount of displacement

compared to the piezoelectric ceramic of Reference 1 even when the voltage in actual use is applied.

As described above, it was confirmed that the piezoelectric ceramic of the present application could achieve larger amount of displacement than the piezoelectric ceramic of Reference 1, and therefore, the present application obviously has different structure and achieves different operation and effect from Reference 1.

Reference 2 (U.S. Patent No. 6,093,339) discloses a piezoelectric ceramic containing two kinds of perovskite-type oxides, but does not disclose or suggest including a tungsten bronze-type oxide.

As the Office Action states, in Reference 2, when comparing the niobium-based piezoelectric ceramic containing alkaline earth titanium with the niobium-based piezoelectric ceramic containing alkaline earth zirconium, the piezoelectric property such as electromechanical coupling factor is almost equal. This shows that in Reference 2, alkaline earth titanium and alkaline earth zirconium have the equal function in the niobium-based piezoelectric ceramic. In other words, Reference 2 does not disclose or suggest that when the perovskite-type oxide containing zirconium is used together with the tungsten bronze-type oxide, the larger amount of displacement is achieved.

Therefore, the present application obviously has different structure and achieves different operation and effect from Reference 2. Thus, Reference 2 does not supply the subject matter missing in Reference 1. Hence, Reference 1 and Reference 2, either individually or in combination, do not disclose or render obvious the subject matter recited in claim 1, and claims 2-9 depending therefrom.

For at least the above reasons, withdrawal of the rejection of claims 1-9 under 35 U.S.C. §103(a) is respectfully requested.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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Attachments:
Comparison Table 1
Comparison Table 2

Date: September 26, 2008

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DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

【Table 1】

Thickness of piezoelectric substrate : 0.6mm

		COMPOSITION OF MAIN COMPONENT x (mol)	COMPOSITION OF MAIN COMPONENT y (mol)	COMPOSITION OF MAIN COMPONENT m (mol)	CONTENT OF MnO TO MAIN COMPONENT (wt%)	RELATIVE DIELECTRIC CONSTANT ε r	ELECTROMECHANICAL COUPLING FACTOR kr (%)	AMOUNT OF DISPLACEMENT (%)
Present invention	Example 2-1	0.19	0.05	0.08	0.31	583	26.7	0.054
	Example 2-2	0.285	0.05	0.01	0.31	536	34.1	0.066
	Example 2-3	0.285	0.05	0.02	0.31	766	34.5	0.079
	Example 2-4	0.36	0.1	0.01	0.31	1211	33.3	0.096
	Example 2-5	0.75	0.05	0.03	0.31	620	30.4	0.063
	Example 2-6	0.6	0	0.01	0.31	429	40.6	0.070
	Example 2-7	0.8	0	0.08	0.31	507	25.5	0.048
Invention of Reference 1	Example 11-1	0.19	0.05	0	0.31	348	30.5	0.048
	Example 11-2	0.19	0.05	0.08	0.31	574	26.7	0.053
	Example 11-3	0.285	0.05	0	0.31	344	34.8	0.052
	Example 11-4	0.285	0.05	0.01	0.31	546	33.5	0.064
	Example 11-5	0.285	0.05	0.02	0.31	741	34.6	0.076
	Example 11-6	0.36	0.1	0	0.31	763	34.3	0.080
	Example 11-7	0.36	0.1	0.01	0.31	1144	32.5	0.089
	Example 11-8	0.75	0.05	0	0.31	374	32.2	0.053
	Example 11-9	0.75	0.05	0.03	0.31	511	29.7	0.057
	Example 11-10	0.6	0	0	0.31	270	42.8	0.058
	Example 11-11	0.6	0	0.01	0.31	444	39.2	0.067
	Example 11-12	0.8	0	0	0.31	239	29.2	0.040
	Example 11-13	0.8	0	0.08	0.31	490	28.3	0.045

【Table 2】

Thickness of piezoelectric substrate : 2.0mm

	COMPOSITION OF MAIN COMPONENT			CONTENT OF MnO TO MAIN COMPONENT (wt%)	AMOUNT OF DISPLACEMENT (%)
	x (mol)	y (mol)	m (mol)		
Experimental example 1	0.19	0.05	0.08	0.31	0.038
Experimental example 2	0.285	0.05	0.01	0.31	0.035
Experimental example 3	0.285	0.05	0.02	0.31	0.036
Experimental example 4	0.36	0.1	0.01	0.31	0.036
Experimental example 5	0.75	0.05	0.03	0.31	0.038
Experimental example 6	0.6	0	0.01	0.31	0.034
Experimental example 7	0.8	0	0.08	0.31	0.031
Comparative example 1	0.19	0.05	0	0.31	0.030
Comparative example 2	0.19	0.05	0.08	0.31	0.030
Comparative example 3	0.285	0.05	0	0.31	0.029
Comparative example 4	0.285	0.05	0.01	0.31	0.031
Comparative example 5	0.285	0.05	0.02	0.31	0.033
Comparative example 6	0.36	0.1	0	0.31	0.029
Comparative example 7	0.36	0.1	0.01	0.31	0.033
Comparative example 8	0.75	0.05	0	0.31	0.028
Comparative example 9	0.75	0.05	0.03	0.31	0.033
Comparative example 10	0.6	0	0	0.31	0.028
Comparative example 11	0.6	0	0.01	0.31	0.031
Comparative example 12	0.8	0	0	0.31	0.024
Comparative example 13	0.8	0	0.08	0.31	0.030